

Ocean & Sea Ice SAF

Downward Longwave Irradiance Product Manual

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1. Introduction

1.1. Overview

This document is one of the product manuals dedicated to the O&SI SAF products users. The main content of these manuals is a description of the product content and format. They also briefly review the algorithms used and the processing methods adopted. The present manual describes the Atlantic DLI products, which cover the Low and Mid Latitudes (LML) area with 3-hourly products, and the Merged Atlantic Product (MAP) area with daily products.

The Ocean & Sea Ice Satellite Application Facility (O&SI SAF) is producing on a preoperational basis a range of air-sea interface products, namely: wind, sea ice characteristics, Sea Surface Temperatures (SST) and radiative fluxes, Surface Solar Irradiance (SSI) and Downward Longwave Irradiance (DLI).

SST, SSI and DLI products are available within 2 hours after the last satellite data acquisition over the following grids:

NAR: Near Atlantic Regional, six areas at 2 km resolution

LML: Low and Mid Latitudes, 100W - 45E and 60N - 60S, at 0.1 degree resolution

MAP: Merged Atlantic Products, 100W - 45E and 98.9N - 60S, at 0.1 degree resolution.

NAR products are derived from NOAA polar orbiter data, LML products from the geostationary satellite data (GOES on the western area, MSG on the eastern area), and MAP products from the geostationary and polar orbiter data (in the northern area). The time samplings corresponding to these grids are shown below:

	NAR	LML	MAP
SST	Every 6 h	3 hourly	12 hourly
SSI		3 hourly	24 hourly
DLI		3 hourly	24 hourly

These products are delivered in GRIB format through Météo-France FTP server <ftp.meteo.fr>, in HDF and NETcdf format through the IFREMER server <ftp://ftp.ifremer.fr/pub/ifremer/cersat/SAFOSI> and in GRIB format through the Regional Meteorological Data Communication Network (RMDCN) to the European Meteorological services. Access to data on <ftp.meteo.fr> is free but subject to prior user registration on the OSI SAF Web site.

Moreover MAP SST is delivered in GRIB format via EUMETcast.

See also the OSI SAF Web site www.osi-saf.org for real time images of the products and updated information.

Section 2 presents the algorithm, section 3 the processing scheme and section 4 the data files. In the present version, the algorithm and processing scheme of NOAA polar orbiter data are not described.

1.2. Glossary

ATL	Atlantic
AVHRR	Advanced Very High Resolution Radiometer
CMS	Centre de Météorologie Spatiale
DLI	Downward Longwave Irradiance
DMI	Danish Meteorological Institute
DNMI	Det Norske Meteorologiske Institutt (now Met.no)

ECMWF	European Center for Medium range Weather Forecast
GOES	Geostationary Operational Environmental Satellite
GRIB	Gridded Binary format
HDF	Hierarchical Data Format
HL	High Latitudes
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
IR	Infrared
LML	Low and Mid Latitudes
LMD	Laboratoire de Météorologie Dynamique
MAP	Merged Atlantic Products
MDB	Match up Data Base
Met.no	Norske Meteorologiske Institutt (Norwegian Meteorological Institute)
MSG	Meteosat Second Generation
NAR	Near Atlantic Regional
NOAA	National Oceanic and Atmospheric Administration
NWC SAF	Nowcasting and very short range forecasting SAF
O&SI SAF	Ocean and Sea-Ice SAF
RMDCN	Regional Meteorological Communication Network
SAF	Satellite Application Facility
SSI	Surface Solar Irradiance
SST	Sea Surface Temperature
TOA	Top of atmosphere
UT	Universal Time

2. Algorithm

2.1. Equations

The O&SI SAF algorithm is a bulk parameterization that uses NWP model outputs to calculate a clear sky Downward Longwave Irradiance (DLI), corrected according to satellite derived cloud information. The calculated DLI is considered as instantaneous since the cloud information, cloud types derived from the NWC SAF classification, for nighttime cases, and Surface Solar Irradiance (SSI), for daytime cases, are instantaneous. This section presents the equations of the DLI parameterization, which are rather simple and satellite independent.

$$L = (\varepsilon_0 + (1 - \varepsilon_0) C) \sigma T_a^4 \quad (1)$$

$$\varepsilon_0 = 1 - (1 + \xi) \exp\{-(1.2 + 3.0 \xi)^{1/2}\} - 0.05 (p_0 - p) / (p_0 - 710) \quad (2)$$

$$\xi = 46.5 (e / T_a) \quad (3)$$

$$C = 1 - E / E_{\text{clear}} \quad \text{“SOLAR” method, for daytime cases} \quad (4)$$

$$C = \sum(n_i C_i) \quad \text{“CLASSIF” method, for nighttime cases} \quad (5)$$

with

- L : downward longwave irradiance at the Earth's surface (W/m^2)
- ε_0 : clear sky emissivity
- C : infrared cloud amount
- T_a : near surface air temperature (K)
- σ : Stefan-Boltzmann constant $\sigma = 5.6696 \cdot 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$
- e : near surface surface water vapor pressure (hPa)
- p : mean atmospheric pressure (hPa)
- p_0 : normal atmospheric pressure, 1013.25 hPa
- E : surface solar irradiance (W/m^2)
- E_{clear} : clear sky surface solar irradiance (W/m^2)
- n_i : fractional sky cover by cloud type i
- C_i : contribution coefficient of this cloud type

The DLI is calculated as the sum of a clear sky and cloud sky contributions (equation (1)). The clear sky emissivity is derived from the near surface air temperature and water vapor pressure, according to the formulation proposed by Prata, 1996 (equations (2) and (3)). The infrared cloud amount, which gives the cloudy sky contribution, is obtained by two different formulations:

- For daytime cases (equation (4)), the infrared cloud amount is directly deduced from the actual to clear sky SSI ratio, as proposed by Crawford and Duchon, 1999.
- For nighttime cases (equation (5)), the infrared cloud amount is expressed as a weighted average of the contributions of the various cloud types covering the pixel.

The DLI cloud types correspond to a simplified cloud classification, merging several types of the NWC SAF detailed cloud classification (presented in Derrien and Le Gléau, 1999, and fully explained in Le Gleau and Derrien, 2000). The values of the cloud contribution coefficients, presented in table 1, have been adjusted on a 1-year data base (July 97 to June 98) gathering DLI measurements, GOES-8 data and observed air temperature and humidity (Brisson et al., 2000). For MSG data, the NWC SAF detailed cloud types will slightly differ from those of GOES data but they should be merged into the same simplified cloud types.

	NWC SAF cloud type		DLI cloud type	C_i	C_i parameter name
1	cloud free land	1	clear	0	PAF_..._CLEAR
2	cloud free sea				
3	land contaminated by snow				
4	sea contaminated by snow/ice				
6	very low (stratiform) cloud	2	low cloud	0.82	PAF_..._LOW
8	low (stratiform) cloud				
10	medium (stratiform) cloud	3	medium cloud	0.78	PAF_..._MEDIUM
11	very high opaque cloud	4	high opaque cloud	0.72	PAF_..._HI_THICK
12	high opaque cloud				
13	high semitransparent thin cloud	5	thin cirrus	0.11	PAF_..._CIRRUS_FIN
14	high semitransparent meanly thick cloud				
15	high semitransparent thick cloud	6	thick cirrus	0.49	PAF_..._CIRRUS
16	high semitransparent above other cloud				
17	fractional cloud	7	fractional cloud	0.15	PAF_..._FRACTIONAL
18	volcanic ash	9	volcanic ash	0	PAF_..._ASH
19	sand cloud	8	sand cloud	0.52	PAF_..._SAND
20	unclassified	0	unclassified	0	PAF_..._UNCLASSIFIED
	low and very low with cloud quality bit of the cloud mask = 0	11	clear re-classified	0	PAF_..._CLR_RCL
	medium cloud with cloud quality bit of the cloud mask = 0	12	medium dubious	0.15	PAF_..._MED_DUBIOUS

Table 1 : cloud types and cloud contribution coefficients used for GOES-8 data
Columns 1 and 3 give the cloud type codes, used in the NWC SAF or O&SI SAF products. In the last column, PAF_... means PAF_PAR_CONTRIB_CLASSIF. The C_i values and parameter names can be found in the configuration file (presented in 4.5 and appendix E).

2.2. References

Brisson, A., P. LeBorgne, A. Marsouin, 2000, Development of algorithms for Downward Long wave Irradiance retrieval at O&SI SAF Low and Mid Latitudes, O&SI SAF Report to EUMETSAT.

Crawford T.M. and C.E. Duchon, 1999, An improved parameterization for estimating effective atmospheric emissivity for use in calculating daytime downwelling longwave radiation. *Journal of Applied Meteorology*, 38, 474-480.

Derrien M. and H. Le Gléau, 1999, Cloud classification extracted from AVHRR and GOES imagery, Proceedings of the 1999 EUMETSAT Meteorological Satellite Data Users' Conference, Copenhagen, 6-10 September 1999.

Le Gléau H. and Derrien M., 2000, Prototype Scientific Description for Meteo-France/CMS, February 2000, SAF/NWC/MFCMS/MTR/PSD, Issue 1, Rev.0.

Prata, A.J., 1996, A new long-wave formula for estimating downward clear-sky radiation at the surface, *Quarterly Journal of the Royal Meteorological Society*, 122, 1127-1151.

3. Processing scheme

3.1. Overview

The delivered DLI products are 3-hourly products on LML area, derived from the geostationary satellite data (GOES and MSG) and daily products on MAP area, derived from GOES, MSG and NOAA polar orbiter satellite data.

This section fully describes the geostationary satellites processing scheme and presents also the merging with the High Latitude (HL) products. GOES or MSG images are processed every hour, producing instantaneous DLI fields. These instantaneous fields are called hourly DLI, because of their time sampling. The hourly DLI are combined to produce 3-hourly and daily DLI. These tasks (sections 3.2 and 3.3) are performed separately for each satellite, GOES or MSG and the mono-satellite products are merged afterwards (section 3.4). The validation and quality control, which concern mono-satellite or multi satellite products, are presented in sections 3.5 and 3.6.

Each DLI field (hourly, 3-hourly or daily, mono or multi-satellite) is associated with a quality index, which includes a confidence level corresponding to the quality of the calculated DLI and information on the processing conditions. The temporal compilations and merging process ingest both DLI fields and their associate quality index. The quality index is mentioned in this section, when needed, but is described in section 4.3.

In the LML area, the DLI products cover both ocean and land. Calculations over land are needed for the validation, since the pyrgeometer stations are essentially in land. The algorithm and processing scheme have been developed for ocean and "normal" land. The calculated DLI may be erroneous over mountains, desert, ice or permanent snow.

3.2. Hourly calculations

The DLI product is on the LML grid, which is a linear scaling in latitude and longitude with a 0.1-degree resolution. The bulk parameterization presented in section 2 is rather simple and the major task of the hourly DLI scheme is to interpolate in space and time the inputs, cloud types, calculated SSI and predicted air temperature and humidity.

Clear sky parameterization

The NWP model outputs are predicted values at 0, 6, 12 or 18h UT of the air temperature, relative humidity and pressure at the surface. These predicted fields are 12 and 18-hour range forecasts on a 1.5-degree resolution grid, obtained twice daily from Meteo-France Numerical Weather Predicting model ARPEGE. These fields are first, re-mapped onto the LML grid and then temporally interpolated at the rounded central time of the satellite image. Finally, the water vapor pressure is derived from the air temperature and relative humidity and the clear sky emittance is calculated by equations (2) and (3).

SOLAR infrared cloud amount

The O&SI SAF SSI scheme calculates an hourly SSI field and, also, the corresponding clear sky hourly SSI field, which is an intermediate product. Both of them are available on the LML grid and they can be entered directly in equation (4).

CLASSIF infrared cloud amount

The NWC SAF detailed classification is in satellite projection at IR resolution. The re-mapping from the satellite projection (GOES or MSG dependant but constant), onto the LML grid is made as follows: to each LML pixel is associated a set of IR pixels, weighted accordingly to their contribution to the coverage of the LML pixel. So the value of a LML pixel will be the weighted average of several IR pixel values, this definition being straightforward for quantitative parameters and more complicate for qualitative ones, such as cloud types.

Therefore, the detailed cloud types are merged into simplified cloud types and converted into cloud contribution coefficient in satellite projection, then re-mapped onto the LML grid. The IR pixels weights correspond to the fractional sky cover of equation (5) and the re-mapped field is the infrared cloud amount.

SOLAR/CLASSIF choice

The SOLAR method is used if a SSI value is available, which requires solar zenith angle being lower than 80 degrees, and if its confidence level is "excellent" or "good". Otherwise, the CLASSIF method is used.

3.3. 3-hourly and daily calculations

The 3-hourly and daily DLI fields are calculated separately for GOES and MSG data, by averaging the valid hourly values available during the 3 or 24-hour period.

The 3-hourly DLI (and SSI) products are the average fluxes calculated on the 3h periods between two consecutive SST fields, this timing choice being consistent with the use of the products by numerical model. As the 3-hourly SST are centered at 1:00, 4:00, 7:00, 10:00, ... the 3-hourly SSI are centered at 2:30, 5:30, 8:30, 11:30, ... UT.

3.4. Merging

The GOES and MSG 3-hourly or daily DLI fields are merged into a LML product and finally, the daily LML and HL products are merged into the MAP product. In overlapping areas, two satellite values are available and the merging process is a choice between them. Such a method can be easily applied to the product and to its quality index. The choice between the two satellite values mainly depends on the corresponding quality indexes, according to the following principles (to be applied when MSG and HL data are available).

GOES and MSG merging

The overlapping area is centered on the 37.5W, i.e. the middle of 75W for GOES and 0 for MSG, and its shape is shown in figure 1.

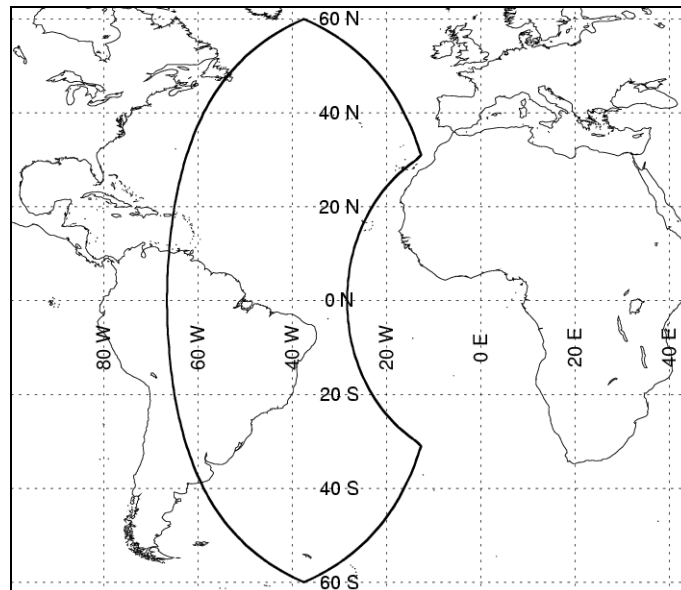


Figure 1: GOES/MSG overlapping area

The area limits correspond to GOES image edge, on the eastern border between 30S and 30N approximately, and, elsewhere, to a maximum satellite zenith angle of 75 degrees.

The DLI value is chosen as follows:

- sun glint case is excluded, if possible
- best confidence level, if any
- GOES west of 37.5W and MSG east of 37.5W

LML/HL merging

The overlapping area is the 50N to 60N latitude band.

The DLI value is chosen as follows:

- best confidence level, if any
- HL value

3.5. Validation

A Match-up data base (MDB) including coincident pyrgeometer measurements and satellite data has been created for each satellite and is routinely updated in the processing scheme. There are actually three types of MDB (hourly, 3-hourly and daily) and each of them consists of elementary files that contains one day of data. This paragraph will not give a detailed description, but only present some essential characteristics.

The hourly MDB is contains calculated and measured DLI data and, also, auxiliary or intermediate parameters of the DLI scheme, in order to assess the accuracy of the product, analyze the error and re-calculate the DLI with an improved algorithm. The measured DLI is a value centered on the time of the satellite data, obtained from several pyrgeometer measurements, by integration or interpolation (the original measurements being 3, 15 or 60 minute averages, depending on the network). The calculated DLI and its quality index are stored on a 0.3-degree square box centered on the pyrgeometer station (9 pixels) and the average on the box is compared to the hourly measure.

The 3-hourly and daily MDB are simpler, since they only aim to assess the accuracy of the product. They essentially contain calculated DLI and quality index on the 9 pixel box, and measured DLI, derived from the original pyrgeometer measurements, by integration or interpolation.

The MDBs are updated in near real time for satellite data and monthly for pyrgeometer measurements, with a delay of about 50 days. Non-automatic updates may occur with a longer delay, 6 months to one year, in case of numerous missing measurements. Statistics and graphics are produced automatically after each monthly update and some of them are available on the O&SI SAF website (see section 4.6 and Appendix F).

3.6. Quality control

The quality of the delivered products is controlled through a visual examination of the products and the automatic production of control parameters.

A visual examination has been made during several months after the start of the routine production. This visual examination can be considered as "experimental" since its main objective was to identify defaults in the processing scheme, program bugs and algorithm weaknesses. An expert has examined on a weekly basis, with a specific interactive tool, the DLI field, its quality index and some intermediate fields of the processing scheme. For instance, the following points were examined mainly on hourly fields and also on 3-hourly and daily fields:

- distribution of missing data
- bad confidence level: frequency, dependence on cloud type or location?
- do some artifacts appear in the sun glint area? between land and sea?

The results of the visual examination have been recorded in hand written documents and in word files.

The precise rules and the format the output files are not yet defined.

The automatic control concerns each product of the DLI scheme (hourly, 3-hourly or daily, mono or multi-satellite) and calculates for each image, the confidence level distribution over the oceanic part of the image. This distribution associates to a given value of the confidence level the percentage of pixels having this value with respect to the number of sea pixels. These statistics are recorded in the information file for each file in GRIB format or in the HDF attributes for each file in HDF format (described in section 4.4 and Appendix C and D) The individual information files are concatenated into compiled information files, separately for each type of product. Graphics showing the temporal evolution of the confidence level distribution are produced automatically (see an example in section 4.7).

4. Data description

4.1. Overview

Data users have access to the following categories of data

For each 3-hourly LML product or daily MAP product:

- a DLI field,
- a quality index field,

These fields are coded in GRIB or HDF format. Each GRIB file is associated to a so called “global information file” presenting information relevant to the whole field. For HDF files, this information is in the HDF attributes.

For each satellite (GOES, MSG or NOAA):

- A configuration file providing the current and past processing information. The SSI and DLI processing schemes have a common configuration file.

For each type of product (i.e. 3-hourly LML or daily MAP)

- A validation statistic report, containing monthly results available since the beginning of the processing (statistic reports may be available separately for each satellite).
- A compiled global information file, i.e. concatenated individual global information files

This section describes the DLI products in 4.2, the quality indexes in 4.3 and briefly presents the data file formats in 4.4 and the other files in 4.5 to 4.7. Additional information can be found in Appendix A to F.

4.2. DLI products

4.2.1. Common characteristics

Physical definition

The DLI is the longwave irradiance reaching the Earth surface in the 4-100 μm band, the irradiance being the radiant flux received per unit area. This defines an instantaneous DLI value, which corresponds to the definition of the hourly DLI. The 3-hourly and daily DLI values are mean values over the considered period of time, 3 or 24 hours.

NB: The 0.1 degree spatial resolution has been chosen for consistency with SST product but is not consistent with the 1, 3 or 24-hour resolution. A 0.2 or 0.3 degree resolution would be sufficient for the hourly and 3-hourly DLI and a larger one for the daily DLI.

Units and range

DLI values are expressed in tenth of in W/m^2 and coded on 16-bit words. The expected range is 100 to 500 W/m^2 (whatever the temporal resolution), these minimum and maximum values being approximate. Unprocessed data, for whatever reason, are equal to -32768 in HDF format or flagged as missing in GRIB section 3.

4.2.2. 3-hourly LML characteristics

Origin

The inputs are GOES or MSG derived cloud type and SSI fields and predicted air temperature and humidity near the surface. The hourly DLI is obtained by a bulk

parameterization. The valid hourly values are averaged into a 3-hourly DLI. The merging is made on the 3-hourly values, by choosing between the GOES and MSG values.

Geographical definition

Projection: linear scaling in latitude and longitude

Resolution: 0.1 degree in latitude and longitude

Size: 1451 columns, 1201 lines

Longitudes and latitude limits: 100W, 45E, 60N, 60S

Conversion of the pixel coordinates into the latitude and longitude of the pixel center:

Longitude = $-100. + 0.1 (\text{column} - 1)$

Latitude = $60. - 0.1 (\text{line} - 1)$

4.2.3. Daily MAP characteristics

Origin

GOES or MSG: the inputs are GOES or MSG derived cloud type and SSI fields and predicted air temperature and humidity near the surface. The hourly DLI is obtained by a bulk parameterization. The valid hourly values are averaged into a daily DLI. The merging is made on the daily values, by choosing between the GOES and MSG values.

NOAA polar orbiter: the algorithm is very similar to the geostationary one but the input data have an irregular time sampling and the daily SSI is calculated in a polar stereographic grid at 1.5 km and the data are remapped by averaging afterwards.

The merging is made on the daily values by a two-step process, first GOES data with MSG data, then the results with NOAA data. Data from distinct satellites are not averaged together.

Geographical definition

Projection: linear scaling in latitude and longitude

Resolution: 0.1 degree in latitude and longitude

Size: 1451 columns, 1500 lines

Longitudes and latitude limits: 100W, 45E, 89.9N, 60S

Conversion of the pixel coordinates into the latitude and longitude of the pixel center:

Longitude = $-100. + 0.1 (\text{column} - 1)$

Latitude = $89.9 - 0.1 (\text{line} - 1)$

4.3. DLI Quality indexes

Each DLI field (hourly, 3-hourly or daily, mono or multi-satellite) is associated with a quality index field, coded in 16-bit words. This index includes a confidence level corresponding to the quality of the calculated DLI and information on the processing conditions, which may have some interest to the user, the O&SI SAF team or both.

The confidence level scale is the same for all SST and radiative fluxes products. The pixels where the calculation has been attempted are labeled on a five level scale: 5 = "excellent", 4= "good", 3="acceptable", 2="bad", 1="erroneous", whereas the pixels where the calculation has not been attempted for normal reasons (out of the processed area, night for SSI, land for SST) have a distinct confidence level 0="unprocessed". The "erroneous" confidence level may be attributed to a parameter missing due to a failure of the algorithm or present but with a very low level of confidence.

The coding of the DLI quality index is described in Appendix A. The hourly index, which is not distributed, is presented since it directly contributes to the 3-hourly and daily indexes.

4.4. File formats

The products are available under the WMO GRIB format for those delivered through the Regional Meteorological Data Communication Network (RMDCN) and Météo-France ftp server, under NetCDF and HDF formats for the products delivered through the IFREMER server.

A complete description of the GRIB format can be found in WMO publication No 306, Manual on Codes. A few parameters are encoded in the GRIB header. The header sections of the GRIB files, specific to the O&SI SAF products, are described in the appendix B.

A GRIB encoding and decoding software is maintained and distributed by the European Center for Medium range Weather Forecast (ECMWF). All information about the software and its ordering is available from ECMWF website <http://www.ecmwf.int/> (Home > Products > Data Services > Software > GRIB). Requests for software should be addressed to:

Data Services
ECMWF
Shinfield Park
Reading
RG2 9AX
UNITED KINGDOM
Fax : +44 118 986 9450
E-mail : Data.Services@ecmwf.int

A so-called "global information file" has been created to palliate the inability of the GRIB header to store all the necessary information. This text file is fully described in Appendix D. A global information file is associated to every GRIB file. The user may note that a DLI field and its quality index both have a global information file, containing duplicated information.

Two historical files gathering all available global information files (one concerning the 3-hourly products and the other the daily products) are available on the web server <http://www.osi-saf.org>

The HDF format is a public format, which is not described here. The HDF attributes have been used to store all the necessary information, which are the GRIB header or in the information file. Appendix D describes the HDF attributes defined for the SSI, DLI and SST data.

A C program to read HDF format is also available under the IFREMER server <ftp://ftp.ifremer.fr/pub/ifremer/cersat/SAFOSI/Tools>. Instructions to install this program are provided in appendix G.

The user can also find other free software that read HDF-EOS files at the following address : <http://hdfEOS.gsfc.nasa.gov/hdfEOS/softwarelist.cfm>

The file name convention for the MAP and LML DLI products disseminated via EUMETCAST are in appendix H.

4.5. Configuration file

The information relative to the processing conditions is given in the configuration file. It contains an identification of the algorithm formalism and a set of parameters, used in the processing scheme (most of them have been presented in section 2). The configuration file is satellite dependent. The SSI and DLI processing schemes have a common configuration file.

The configuration file is an ASCII file, which is read by the programs of the processing chain. It records all the consecutive versions with the dates of the change in the header of the file. Comments are also added in the parameter section. It should be managed with a version tool. The version number is at present manually updated in the auxiliary data. Appendix E shows the SSI-DLI configuration file, relative to GOES processing scheme.

4.6. Validation results

Error statistics are calculated monthly for the three temporal resolutions, separately for each satellite, GOES or MSG, using the Match Up Data Base presented in 3.6. They are stored in ASCII files, called validation statistic reports. The mono-satellite reports over one month are rather detailed, including overall results, results per station and results per day. They can be combined to produce reports over longer period or LML or MAP reports, merging results from several satellites (GOES, MSG and possibly NOAA). The content of the validation statistic report, which is used both for SSI and DLI, is described in Appendix F.

Statistics covering 3 month period are presented in the Quarterly Reports, and Validation Reports on long term series are also produced. Both kinds of reports are available on the Web Site.

For each satellite, a limited set of stations, where in situ data are available in a reasonable delay and rather well distributed in the processed area, is considered as the reference set of stations to be used for most of the routine validation. The reports over long period, which are distributed to users, concern the limited set(s) of stations.

The validation stations of the limited sets are presented in figure 2 and table 2. An example of daily DLI validation for GOES and MSG over one year is given in figure 3.

name	abv*	latitude	longitude
Bondville_IL	bon	40.060	-88.370
Goodwin_Creek_MS	gwn	34.250	-89.870
Central_Facility	cen	36.605	-97.485
Bermuda	ber	32.300	-64.750
Chesapeake_Light	chl	36.910	-75.710
Penn_State_PA	psu	40.720	-77.930
Carpentras_CRC	cac	44.083	5.059
Camborne	cam	50.367	-5.533
De_Aar	daa	-30.667	23.983

Table 2 : GOES and MSG limited sets of pyrgeometer stations

Column 2 gives the abbreviated name that is used in the SAF O&SI validation figures and listings. The stations of the first lines (until "psu") are in GOES area, those of the three last lines ("cac", "cam" and "daa") are in MSG area.

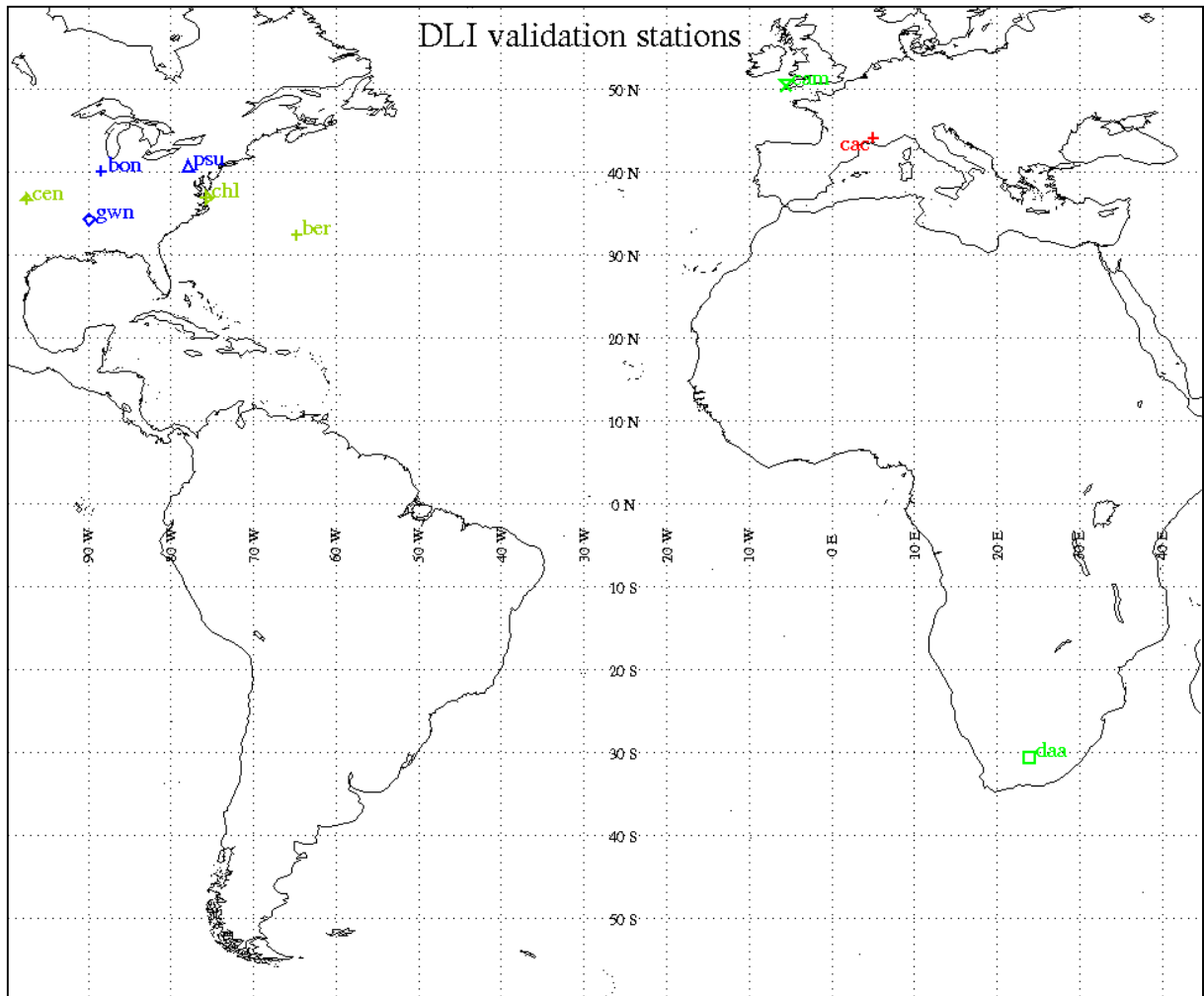


Figure 2 : GOES and MSG limited sets of pyrogeometer stations

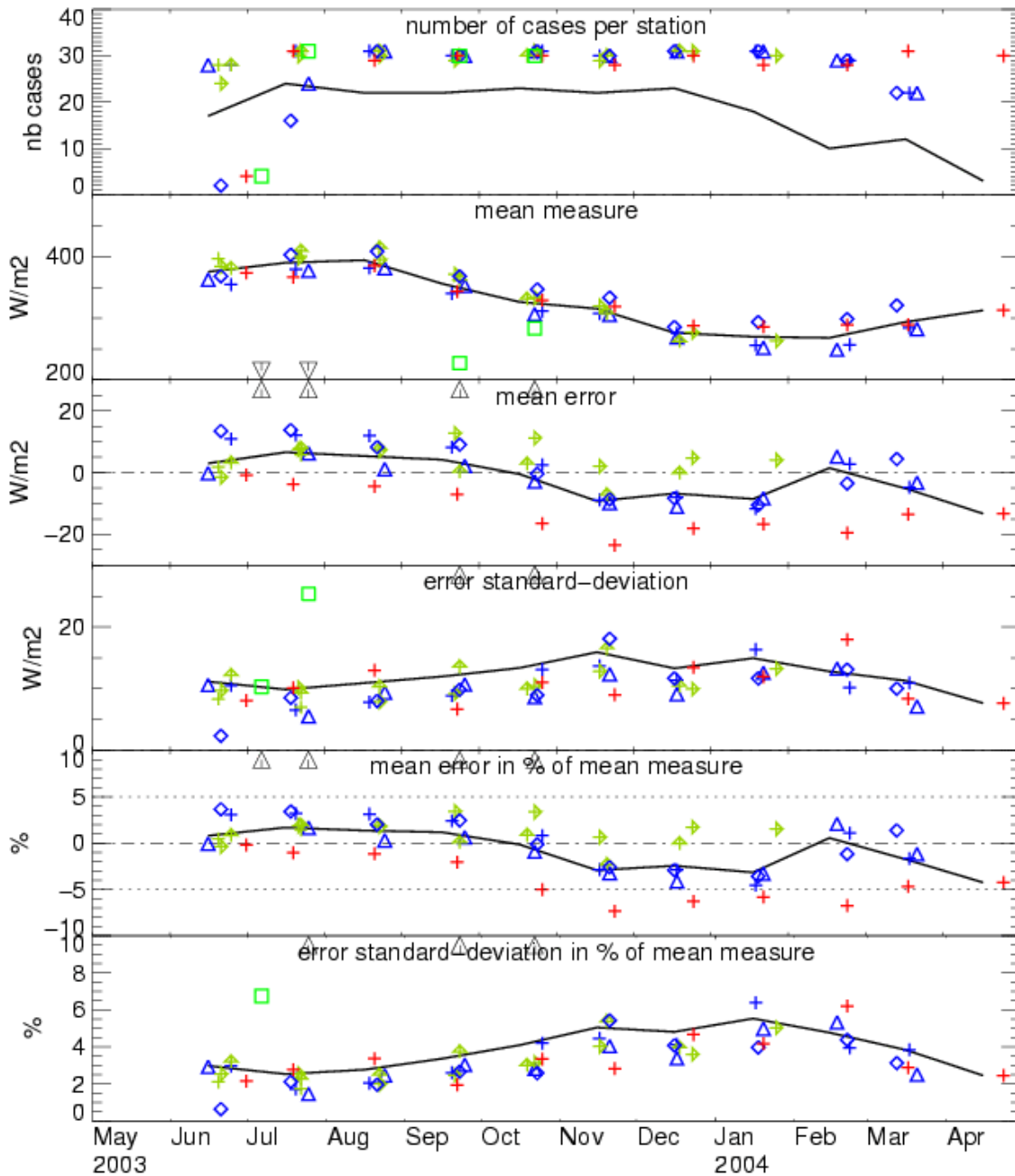
LML daily DLI seasonal variation 2003/06/01–2004/04/30 LMT subset

stations: psu bon chl cen gwn ber cac daa

line = stations together (filtered data) symbols = stations separately

overall statistics :

measure in W/m2 :	mean 331.8	stdev 58.3	1609 cases
error in W/m2 :	mean -1.0	stdev 14.0	rms 14.1
error in % :	mean -0.3	stdev 4.2	rms 4.2



printed on 13/Jun/2004 0601

Figure 3 : Example of daily DLI validation

4.7. Quality control results

The automatic quality control, presented in 3.7, calculates the confidence level distribution over the oceanic part of the image, stores the results in the global information file of the image (described in Appendix C) and concatenates these files into a compiled global information file. This compiled file is specific to each type of product (3-hourly LML, daily MAP or any intermediate product) and starts at the beginning of the processing.

Figures are also produced automatically covering different periods of time, the last ten days (not shown), the previous month or the last 12 months (figure 4). The 15% of unprocessed data remaining in June 2004 show that the MAP area is not fully covered: the HL product, based on NOAA data acquired in Oslo, does not cover the north-west and the LML product, based on GOES sectors, does not cover the south-west.

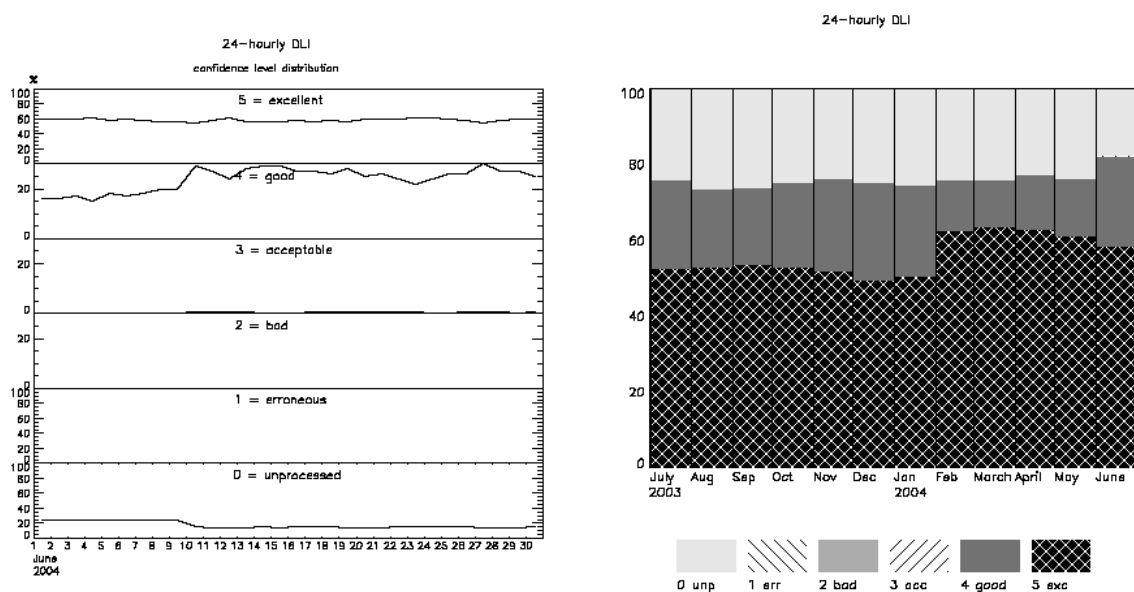


Figure 4 : Example of quality control results for the daily MAP DLI, over one month (left) and over one year (right)

4.8. O&SI SAF website

An O&SI SAF website www.osi-saf.org has been implemented in early 2004 to provide general information on the O&SI SAF, detailed information on the O&SI SAF products and their quality, as well as near real-time access to O&SI SAF products quick-looks and files.

This section provides some additional information about the general organization of the site, focusing on the way to access quick-looks and other relevant information concerning ATL DLI product.

The status of the LML and MAP Fluxes (SSI and DLI) production is indicated in the table on the right side of the home page.

From the home page the user can get access to :

- the ATL DLI products presentation by selecting in the left-hand side column "Products presentation", and then "[Atlantic Downward longwave Irradiance](#)".
- LML and MAP Fluxes (SSI and SSI) products configuration, by selecting Products Configuration.
- ATL DLI quality results, by selecting in the left-hand side column "Production centers WEB sites " , and then in the table "Centre de meteorologie Spatiale de Meteo-France" , in section "DLI", by selecting "validation"

Figure 4 shows the O&SI SAF website entry page for the Atlantic DLI products images

Downward Longwave Irradiance on Atlantic excepted High Latitudes Images

Select a product type, a geographical area and then push the 'Validate' button to load the selected image.

Geographic areas are shown on the image below the form.

Important note: the sub-areas have been defined only for zooming purpose; the products are available only on the LML or MAP areas.

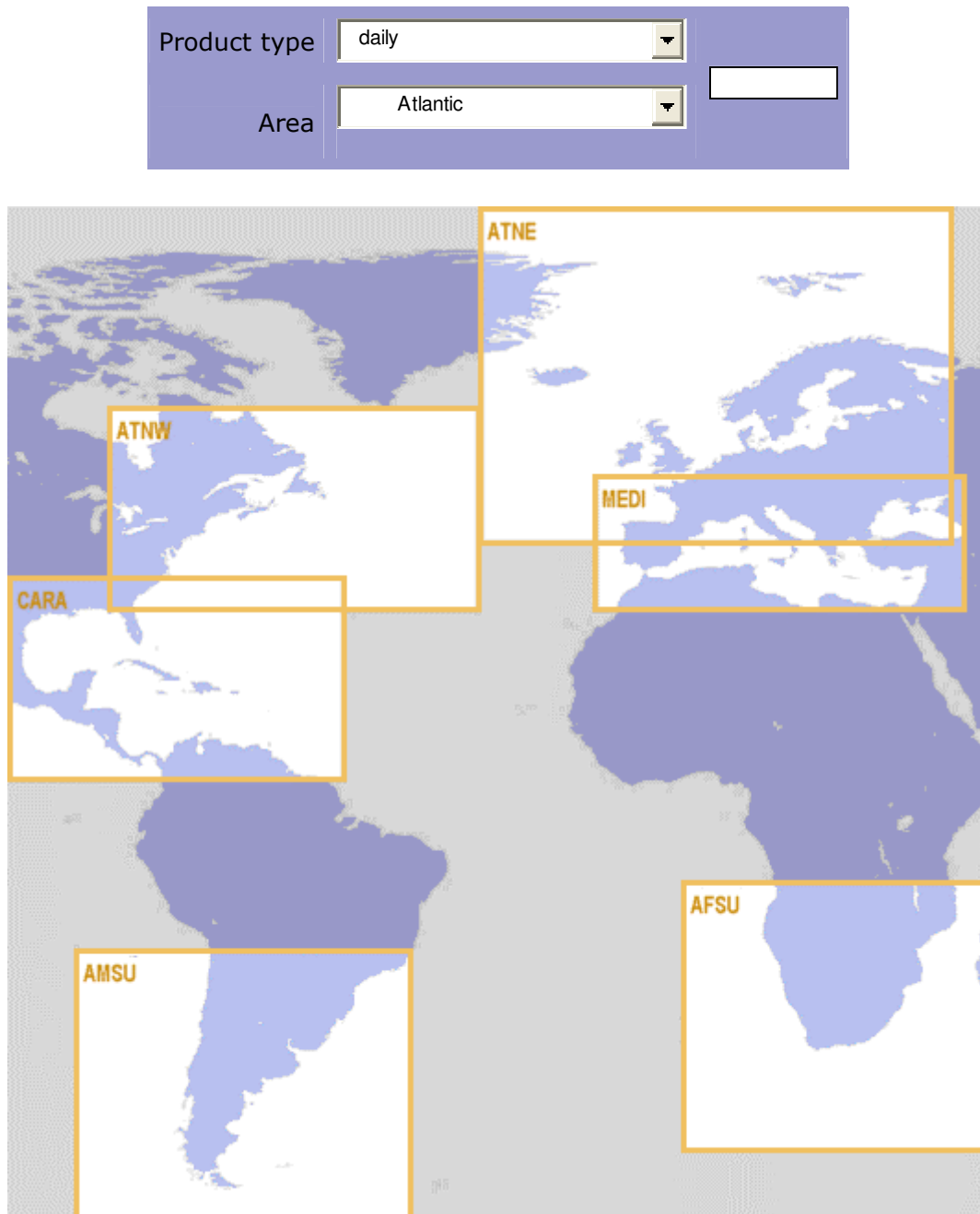


Figure 4 : entry page of the O&SI SAF website for the Atlantic DLI products images

From this entry page, the user has to select a product type (3-hourly or daily) and a geographical area, using the two selection boxes in the bottom, then to press the "Load"

button to display the last corresponding quick-look. For the Atlantic DLI products, the geographical sub-areas are proposed for quick-looks display only, but the products files cover the whole Atlantic area (LML or MAP).

APPENDIX A: DLI quality indexes

Hourly DLI quality index	
bit	signification
0-2	<p>Confidence level 5 = excellent, 4 = good, 3 = acceptable, 2 = bad, 1 = erroneous, 0 = unprocessed</p> <p>This confidence level is based upon the internal results of the DLI algorithm:</p> <ul style="list-style-type: none"> excellent: SOLAR method using SSI of confidence level "excellent" or CLASSIF method with DLI cloud type in [0,9] and nighttime good: SOLAR method using SSI of confidence level "good" or CLASSIF method with DLI cloud type 11 or 12 and nighttime acceptable: CLASSIF method with DLI cloud type in [0,9] and daytime bad: CLASSIF method with DLI cloud type 11 or 12 and daytime erroneous: no cloud classification or failure in DLI calculations unprocessed: out of area <p>The DLI cloud types from 0 to 9 are not problematic types, while the 11 and 12 ones correspond respectively to "clear reclassified" or "medium dubious" (close to the thresholds, according to the quality flag of the NWC SAF mask)</p>
3	unused
4	unused
5	weak sunglint conditions sun glint conditions in at least one IR pixel
6	ice presence ice detected in at least one IR pixel
7	aerosol presence aerosol detected in at least one IR pixel
8	clear pixel all IR pixels are of DLI cloud type "clear"
9	overcast pixel cloud cover=100% and all IR pixels are of DLI cloud type(s): low, medium, high opaque, thin or thick cirrus
10	DLI calculated by the CLASSIF method
11	DLI calculated by the SOLAR method
12-14	bit 15 dependant
15	no DLI value
If bit 15 = 0	
bit	signification
12-14	unused
If bit 15 = 1	
bit	signification
12	internal error when calculating the cloud contribution coefficient
13	CLASSIF cloud contribution coefficient cannot be calculated at least, one IR pixel is "unclassified" by the NWC SAF classification
14	out of the processed area

The table concerns the LML hourly DLI products (merged and mono-satellite), which are not distributed. The LML pixel of 0.1 degree in latitude and longitude corresponds to a weighted average of several satellite IR pixels. The NWC SAF cloud classification is made in satellite projection and all information at IR pixel resolution come from this classification.

3-hourly or daily DLI quality index	
bit	signification
0-2	Confidence level 5 = excellent, 4 = good, 3 = acceptable, 2 = bad, 1 = erroneous, 0 = unprocessed This confidence level is deduced from the N hourly input confidence levels, with the following rules: 0, when the N hourly confidence levels are 0, or 1, when the N hourly confidence levels are 0 or 1, or average of N' hourly confidence levels (calculated in real value and rounded). N is the number of hourly values expected for the 3-hourly or daily calculation N' is the number of valid hourly values effectively used or, which is equivalent, the number of hourly confidence levels equal or better than "bad"
3-4	Satellite code 0 = Goes, 1 = Meteosat (MTP or MSG), 2 = Polar (NOAA or EPS), 3 = unused
5	sun glint occurrence sun glint presence for, at least, one hourly value used in the calculation
6	snow or sea ice occurrence snow or sea ice presence for, at least, one hourly value used in the calculation
7	aerosol occurrence detected for, at least, one IR pixel in one hourly value used in the calculation
8-9	unused
10-14	bit 15 dependant
15	no DLI value
If bit 15 = 0	
bit	signification
10	unused
11-14	number of hourly values used in the 3-hourly or daily calculation divided by the number of expected values (i.e. 3 or 24), multiplied by 10 for coding
If bit 15 = 1	
bit	signification
10-11	unused
12	no hourly values available for the 3-hourly or daily calculation
13	no satellite data only used for merged product
14	out of the processed area

APPENDIX B: Limited description of the GRIB file header

The header sections of the GRIB files, specific to the O&SI SAF products, are given in the following table. The parameter names or values with a star * refer to the GRIB manual, in WMO publication No 306 - Manual on Codes. The table below is consistent with the KSEC1 content description in this manual.

element	content	value
ksec1*		
1	version number	3
2	centre identifier	211 for Lannion
3	process identifier	229 for Lannion
4	grid definition	255 (grid defined in section 2)
5	flag section 2 and 3	128* for the quality index fields 192* for the other fields
6	parameter	11* for sst 115 for dli 116 for ssi 210 for sst quality index 211 for sst time 215 for dli quality index 216 for ssi quality index
7	type of level	102* sst and sst time 1* others
8	level	0*
10-14 and 21	reference time	
15	time unit indicator	1* for 3-hourly and 12-hourly products 2* for daily products
16	P1*	0
17	P2*	0
18	time range indicator	0
19	number of products included	number of hourly fields (or orbits) actually included in the product
20	number of products missing	number of missing hourly fields (or orbits)
23	decimal scale factor	0*
24	local use flag	0* (no local use)
ksec3*		
1	bitmap flag	1* for the quality index field 0* for the other fields

APPENDIX C: Description of the global information file

A global information file is associated to each SST, SSI and DLI GRIB file, including information that were not compatible with GRIB format. The file is an ASCII file where the separator between each field is the blank character.

Example:

```
sst12 map 2001-03-27 1200 2001-03-27 0600 0 1 10 41 31 3 17 1 7 0 0 0 0 230 28551
28531 50 0 -99999 -99999 -99999 0 0 0 0 0 0 0 0 -99999 -99999 -99999 goes08 noaa14
noaa16 // g1.0p1.1 n1.0p2.1 h1.0p1.0 //
```

field name	purpose
product_name	coded product name: product acronym: sst, ssi or dli prefixed by q for a quality index, t for a time suffixed by the time resolution in hours: 1, 3, 12 or 24
grid_id	grid identifier: hl, lml, map mocc, mori, norv, cana, gasc, mnor (NAR SST only)
ref_date	reference date and time of the product in UT the reference time is a nominal mean instant format : YYYY-MM-DD (date) and HHMM (time)
ref_time	
start_date	date and time in UT of the first satellite data, used in the product format : YYYY-MM-DD (date) and HHMM (time)
start_time	
slot	orbit or slot number when the product is derived from a unique satellite orbit or slot, 0 otherwise
global_quality_flag	overall confidence level: 0 → normal 1 → suspect 2 → extremely suspect interactively assigned in the processing scheme
nb_hourly_field	number of hourly fields (or orbits) actually included in the product; it may be lower than expected
lvl0_percent	percentage of sea pixels with confidence level 0, 0 to 100
lvl1_percent	percentage of sea pixels with confidence level 1, 0 to 100
lvl2_percent	percentage of sea pixels with confidence level 2, 0 to 100
lvl3_percent	percentage of sea pixels with confidence level 3, 0 to 100
lvl4_percent	percentage of sea pixels with confidence level 4, 0 to 100
lvl5_percent	percentage of sea pixels with confidence level 5, 0 to 100
ovl1_nb	statistic on the GOES/MSG overlapping area : ovl1_nb is the number of comparison case ovl1_mean1 is the mean GOES value ovl1_mean2 is the mean MSG value ovl1_sigma is the standard deviation of the difference 0 in these 4 fields means that no comparison has been attempted due to the lack of GOES or MSG data 0 in the first field and -999 in the others means that no data were comparable in the overlapping area
ovl1_mean1	
ovl1_mean2	
ovl1_sigma	
ovl2_nb	statistic on the GOES/NAR overlapping area
ovl2_mean1	
ovl2_mean2	
ovl2_sigma	
ovl3_nb	statistic on the GOES/HL overlapping area
ovl3_mean1	
ovl3_mean2	

ovl3_sigma	
ovl4_nb	statistic on the MSG/NAR overlapping area
ovl4_mean1	
ovl4_mean2	
ovl4_sigma	
ovl5_nb	statistic on the MSG/HL overlapping area
ovl5_mean1	
ovl5_mean2	
ovl5_sigma	
ovl6_nb	statistic on the NAR/HL overlapping area
ovl6_mean1	
ovl6_mean2	
ovl6_sigma	
satid(5)	identifiers of the satellites, whose data are used in the product the array dimension is 5, since a merged product cannot concern more than 5 satellites examples: noaa16, goes08, meteosat7, msg1 an empty field contains one / character
algorithm_version_id(5)	algorithm version identifiers (correspond to the satellite identifiers) coded as : <a><x.y>p<z.t> with: <a><x.y> algorithm version. <a> process code: g → goes n→ nar h→ hl <x.y> version number of this process p<z.t> configuration file version for instance: g1.1p2.0 an empty field contains one / character

Comments:

The reference time is a nominal value of the mean time of the product in UT:

NAR SST	: 0500 and 1500 for NOAA-14 0200 and 1200 for NOAA-16
hourly Atlantic SST	: 0100, 0200, 0300, ..., 2300
hourly SSI or DLI	: 0030, 0130, 0230, ..., 2330
3-hourly Atlantic SST	: 0100, 0400, 0700, 1000, 1300, 1600, 1900, 2200
3-hourly SSI or DLI	: 0230, 0530, 0830, 1130, 1430, 1730, 2030, 2330
12-hourly Atlantic SST	: 0000 and 1200
daily SSI or DLI	: 1200

The global quality flag is normally 0. It is equal to 1 or 2, when a problem is known by the producer: for instance, bad quality of a channel critical for the product, GOES-8 hourly SST filed close to the “midnight” calibration problem, ...

The parameters beginning by “ovl” are mainly for O&SI SAF internal validation. A merged product contains one or more overlapping areas between two satellites, where some statistics are calculated. 6 types of overlapping have been pre-defined to cover all situations encountered on the SST, SSI and DLI products.

APPENDIX D: Definition of the HDF attributes

attribute name	type	purpose
files attributes		
HDF_version_id	char*8	HDF software version
HDF_EOS_version_id	char*8	HDF-EOS software version
grid attributes		
product_name	char*80	product name (fully written) ex: Sea Surface Temperature
product_id	char*12	product identifier: sst, ssi or dli
producer_id	char*12	producer identifier, i.e. M-F/DP/CMS
project_id	char*12	project identifier, i.e. O&SI SAF
grid_id	char*8	grid identifier: hl, lml, map mocc, mori, norv, cana, gasc, mnor (NAR SST only)
lat_min	float32	minimum and maximum latitudes and longitudes over all pixels of the grid in degrees, western longitudes being negative
lon_min	float32	
lat_max	float32	
lon_max	float32	
satellite_id	char*8 [5]	identifiers of the satellites, whose data are used the array dimension is 5, since a merged product cannot concern more than 5 satellites examples: noaa16, goes08, meteosat7, msg1 an empty field contains one / character
orbit_number	uint16	orbit or slot number when the product is derived from a unique satellite orbit or slot, 0 otherwise
central_date	char*8	reference date and time of the product in UT the reference time is a nominal mean instant format : YYYYMMDD (date) and HHMN (time)
central_time	char*8	
range_start_date	char*8	date and time in UT of the first and last satellite data, used in the product format : YYYYMMDD (date) and HHMN (time)
range_stop_date	char*8	
overall_quality_flag	char*20	overall confidence level: normal , suspect or extremely_suspect interactively assigned in the processing scheme
nb_hourly_field	uint16	number of hourly fields (or orbits) actually included in the product; it may be lower than expected
quality_level	uint16[6]	for the six confidence level values (0 to 5) percentage of sea pixels having this value
compilation_method	char*12	compilation method: mean or integration
ovl_nb	uint16[6]	statistics on 6 overlapping areas between two satellites: number of comparison cases
ovl_mean1	uint16[6]	product mean value using satellite 1
ovl_mean2	uint16[6]	product mean value using satellite 2
ovl_sigma	uint16[6]	standard deviation of the difference

attribute name	type	purpose
algorithm_version_id	char*40	algorithm version identifiers (correspond to satellite identifiers) coded as : <a><x.y>p<z.t> with: <a><x.y> algorithm version. <a> process code: g → goes n → nar h → hl <x.y> version number of this process p<z.t> configuration file version for instance: g1.1p2.0
field attributes		
long_name	char*12	coded product name: product acronym: sst, ssi or dli prefixed by q for a quality index, t for a time suffixed by the time resolution in hours: 1, 3, 12 or 24
units	char*12	unit of the data for instance: K, W/m ² , minutes, none
valid_range	int16[2]	effective minimum and maximum values of the field
missing_value	int16	value used in case of missing data
scale_factor	float64	scale factor value_in_unit = value_in_the_file * scale_factor

Comments:

The reference time is a nominal value of the mean time of the product in UT:

NAR SST : 0500 and 1500 for NOAA-14
 : 0200 and 1200 for NOAA-16
hourly Atlantic SST : 0100, 0200, 0300, ..., 2300
hourly SSI or DLI : 0030, 0130, 0230, ..., 2330
3-hourly Atlantic SST : 0100, 0400, 0700, 1000, 1300, 1600, 1900, 2200
3-hourly SSI or DLI : 0230, 0530, 0830, 1130, 1430, 1730, 2030, 2330
12-hourly Atlantic SST : 0000 and 1200
daily SSI or DLI : 1200

For LML and MAP grids, which are a regular scaling in latitude and longitude, the lat_max and lon_min parameters can be used to convert the pixel column and line numbers into the latitude and longitude of the pixel center by:

$$\begin{aligned} \text{longitude} &= \text{lon_min.} + 0.1 (\text{column} - 1) \\ \text{latitude} &= \text{lat_max} - 0.1 (\text{line} - 1) \end{aligned}$$

The global quality flag is usually “normal”. It is “suspect” or “extremely_suspect”, when a problem is known by the producer: for instance, bad quality of a channel critical for the product, GOES-8 hourly SST field close to the “midnight” calibration problem, ...

The parameters beginning by “ovl” are mainly for O&SI SAF internal validation. A merged product contains one or more overlapping areas between two satellites, where some statistics are calculated. The “ovl” array index corresponds to 6 pre-defined comparisons, covering all situations encountered on the SST, SSI and DLI products:

1=GOES/MSG 2=GOES/NAR 3=GOES/HL 4=MSG/NAR 5=MSG/HL 6=NAR/HL

APPENDIX E: The SSI/DLI configuration file

```

#-----
#
#           file parameters of the safo flux applications
#
# geoflx : calculation of the radiative fluxes derived from one geostationary
#         satellite
# mrgflx : merging of the radiative fluxes derived from several satellite
# ctrlflx : control of the retrieved flux fields through match up database
#-----
#
# two sections in this file :
#   section 1 : ArchiPEL management
#   section 2 : Algorithms parameters
#
# When section 2 is modified, ALL_PAR_VERSION should be increased
#-----
#-----
# History
#   date       version  comment
# 10/04/2001  g1.0p1.0  initial version
# 11/05/2001  g1.0p1.1  change value of PAF_PAR_DRIFTCALIB
#-----
#----- section 1 -----
#-----
# max delivery time delay for flux products (in hours)
GEO_PAR_DELIVERY_TIME_DELAY=2
#-----
# on line sst fields duration in hours
GEO_PAR_KEEP_ON_LINE_SSI1=48
GEO_PAR_KEEP_ON_LINE_SSI3=48
GEO_PAR_KEEP_ON_LINE_SSI24=48
GEO_PAR_KEEP_ON_LINE_DLI1=48
GEO_PAR_KEEP_ON_LINE_DLI3=48
GEO_PAR_KEEP_ON_LINE_DLI24=48
GEO_PAR_KEEP_ON_LINE_AUX=48
GEO_PAR_KEEP_ON_LINE_WRK_SRC=2
MRG_PAR_KEEP_ON_LINE_SSI3=48
MRG_PAR_KEEP_ON_LINE_SSI24=48
MRG_PAR_KEEP_ON_LINE_DLI3=48
MRG_PAR_KEEP_ON_LINE_DLI24=48
#-----
# on line control images duration in days
ALL_PAR_NB_DAYS_CONTROL_SSI1=3
ALL_PAR_NB_DAYS_CONTROL_SSI3=10
ALL_PAR_NB_DAYS_CONTROL_SSI24=30
ALL_PAR_NB_DAYS_CONTROL_DLI1=3
ALL_PAR_NB_DAYS_CONTROL_DLI3=10
ALL_PAR_NB_DAYS_CONTROL_DLI24=30
#-----
# on line quicklook images duration in days
ALL_PAR_NB_DAYS_QUICKLOOK=100
#-----
# on line graphe images duration in days
ALL_PAR_NB_DAYS_GRAPHE=400
#----- section 2 -----
#-----
# until 11/05/01
#   ALL_PAR_VERSION=g1.0p1.0
# from 11/05/01
ALL_PAR_VERSION=g1.0p1.1
#-----
export ALL_PAR_VERSION
#-----
# start acquisition time of the first image to be processed (hhmm)
GEO_PAR_FIRST_SAMPLE_TIME=0015

```

```

#step time between two consecutive images to be processed (hhmn)
GEO_PAR_SAMPLE_PERIOD=0030

export PAF_PAR_FIRST_SAMPLE_TIME PAF_PAR_SAMPLE_PERIOD

#Sample product definitions
PAF_PAR_FIRST_SAMPLE_IN_FLX1=1
PAF_PAR_FIRST_SAMPLE_IN_FLX3=3
PAF_PAR_FIRST_SAMPLE_IN_FLX24=1
PAF_PAR_NUMBER_OF_SAMPLES_IN_FLX1=2
PAF_PAR_NUMBER_OF_SAMPLES_IN_FLX3=6
PAF_PAR_NUMBER_OF_SAMPLES_IN_FLX24=48

#..... sub-section 2.1 (geoflx application parameters) .....

GEO_PAR_VIEW_SAT=goesnorthsouth
export GEO_PAR_VIEW_SAT

#view angles limits definition
PAF_PAR_ZENSOL_MAX=80
PAF_PAR_ZENSAT_MAX=85

# threshold of albedo on coastal area
PAF_PAR_COAST_ALB_THRESHOLD=0.05
export PAF_PAR_COAST_ALB_THRESHOLD

#goes visible calibration coefficients
PAF_PAR_FCORCALIB=1.10
# until 11/05/01
#   PAF_PAR_DRIFTCALIB=0.000208
# from 11/05/01
PAF_PAR_DRIFTCALIB=0.000164
PAF_PAR_TREFCALIB=17758

#Albedo_min delta and max Albedo_max
PAF_PAR_EPSAMIN=0.05
PAF_PAR_MAXAMAX=1.0

#cloud absorption factor
PAF_PAR_MABSCLD=0.4

PAF_PAR_TRSNUAG=0.96

export PAF_PAR_ZENSOL_MAX PAF_PAR_ZENSAT_MAX
export PAF_PAR_FCORCALIB PAF_PAR_DRIFTCALIB PAF_PAR_TREFCALIB
export PAF_PAR_EPSAMIN PAF_PAR_MAXAMAX
export PAF_PAR_MABSCLD
export PAF_PAR_TRSNUAG

#-----
# environment variables used in DLI programs
#-----

PAF_PAR_CONTRIB_CLASSIF_UNCLASSIFIED=0.00
PAF_PAR_CONTRIB_CLASSIF_CLEAR=0.00
PAF_PAR_CONTRIB_CLASSIF_LOW=0.82
PAF_PAR_CONTRIB_CLASSIF_MEDIUM=0.78
PAF_PAR_CONTRIB_CLASSIF_HI_THICK=0.72
PAF_PAR_CONTRIB_CLASSIF_CIRRUS_FIN=0.11
PAF_PAR_CONTRIB_CLASSIF_CIRRUS=0.49
PAF_PAR_CONTRIB_CLASSIF_FRACTIONAL=0.15
PAF_PAR_CONTRIB_CLASSIF_ASH=0.00
PAF_PAR_CONTRIB_CLASSIF_SAND=0.52
PAF_PAR_CONTRIB_CLASSIF_CLR_RCL=0.00
PAF_PAR_CONTRIB_CLASSIF_MED_DUBIOUS=0.15
export PAF_PAR_CONTRIB_CLASSIF_UNCLASSIFIED PAF_PAR_CONTRIB_CLASSIF_CLEAR

```

```
export PAF_PAR_CONTRIB_CLASSIF_LOW PAF_PAR_CONTRIB_CLASSIF_MEDIUM
export PAF_PAR_CONTRIB_CLASSIF_HI_THICK PAF_PAR_CONTRIB_CLASSIF_CIRRUS_FIN
export PAF_PAR_CONTRIB_CLASSIF_CIRRUS PAF_PAR_CONTRIB_CLASSIF_FRACTIONAL
export PAF_PAR_CONTRIB_CLASSIF_ASH PAF_PAR_CONTRIB_CLASSIF_SAND
export PAF_PAR_CONTRIB_CLASSIF_CLR_RCL PAF_PAR_CONTRIB_CLASSIF_MED_DUBIOUS
```

```
PAF_PAR_CONTRIB_MASK_CLEAR=0.00
PAF_PAR_CONTRIB_MASK_CLOUD=0.63
export PAF_PAR_CONTRIB_MASK_CLEAR PAF_PAR_CONTRIB_MASK_CLOUD
```

```
PAF_PAR_P0_PRATA=1013.25
PAF_PAR_C_PRATA=46.5
export PAF_PAR_P0_PRATA PAF_PAR_C_PRATA
```

```
#..... sub-section 2.2 (mrgflx application parameters) .....
```

```
#..... sub-section 2.3 (ctlflx application parameters) .....
```

```
CTL_PAR_MDBSSI_STAT_NOTEMIN=0
CTL_PAR_MDBDLI_STAT_NOTEMIN=0
export CTL_PAR_MDBSSI_STAT_NOTEMIN CTL_PAR_MDBDLI_STAT_NOTEMIN
```

```
#----- end of file -----
```

APPENDIX F: Description of a SSI/DLI validation statistic report

A validation statistic report contains validation results relative to hourly, 3-hourly or daily SSI or DLI products (mono-satellite, LML or MAP, over one month or a longer period). The reports used for SAF internal validation are often more detailed than those distributed to the users, the format presented here is valid for both types.

A validation statistic report is an ASCII file composed of several types of line:
title line, blank line, border line, legend line, separation line and statistic line.

The file is commonly organized as follows:

```

line 1 : title line
line 2 : blank line
line 3 : blank line
line 4 : border line
line 5 : legend line
line 4 : border line
following lines :   statistic line(s)
                   comment line
                   statistic line(s)
                   comment line           ...and so on

```

Line content and format

title line:

(blank characters) xxx zzz flux M D B printed on yyyy-mm-dd hhhh
 where xxx = H L for high latitudes
 L M L for low and mid latitudes
 G L M L for low and mid latitudes, GOES data only
 M L M L for low and mid latitudes, MSG data only
 M A P for Merged Atlantic Product
 zzz = H O U R L Y or D A I L Y or 3 - H O U R L Y
 flux = D L I or S S I

border line:

```

+--+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+

```

legend line:

```

|t|sta| begin | end | occ |msrmea|msrsig|calmea|calsig| errmea (%msr) | errsigs (%msr) | errqua (%msr) | corr|

```

separation line:

FORTTRAN format: ("|",a1,"|",a3,"|",a10,"|",a10,"|",5x,"|",4(6x,"|"), 1x, 3(6x," ", 6x,"|"),5x,"|")

statistic line:

This line contains statistical results between satellite-derived values (calculated) and the corresponding in-situ measurements (measured), for one station or a set of stations over a variable period of time:

FORTTRAN format: ("|",a1,"|",a3,"|",a10,"|",a10,"|",i5,"|",4(f6.2,"|"),1x, 3(f6.2," (" ,f6.2,"|"),f5.2,"|")

The statistic line contains the following parameters:

code, sta, begin, end, occ, msrmea, msrsig, calavg, calsig, erravg, erravgp, errsig, errsigp, errrms, errrmsp, cor

which are defined as indicated below:

code: code describing the type of the statistics, i.e. period and station(s)

G or g = several days, several stations

m = one month, several stations

S or s = several days, one station

e = one month, one station, values considered as dubious or erroneous

D = one day, several stations

(capital letters are used for statistics directly calculated on a MDB file and lower case letters for statistics derived from other statistic reports)

sta: set of stations shortname, with the following values:

ALL = all stations available

LMT = limited set of stations well distributed in the area

VAL = SAF O&SI internal use

or station shortname, if only one station is used

begin	: date of the first day of the statistics, coded yyyy-mm-dd	
end	: date of the last day of the statistics, coded yyyy-mm-dd	
occ	: number of cases	
msrmea	: mean measured flux	W/m ²
msrsig	: standard deviation of the measured flux	W/m ²
calavg	: mean calculated flux	W/m ²
calsig	: standard deviation of the calculated flux	W/m ²
erravg	: mean error , i.e. calculated flux - measured flux	W/m ²
erravgp	: mean SSI error in percentage of the mean measure	%
errsig	: standard deviation of the error	W/m ²
errsigp	: standard deviation of the error in percentage of the mean measure	%
errrms	: root mean square (rms) error	W/m ²
errrmsp	: rms error in percentage of the mean measure	%
corr	: correlation coefficient	

Missing values are coded -99.99, except the correlation coefficient which is -9.99.

APPENDIX G: Help in reading HDF format

A C program to read HDF format (read_hdf.c) is available under the IFREMER server <ftp://ftp.ifremer.fr/pub/ifremer/cersat/SAFOSI/Tools>.

To install this program proceed as follows:

- Download the HDF 4.1r5 software from ftp://ftp.ncsa.uiuc.edu/HDF/HDF/HDF_Current (get HDF4.1r5.tar.gz)
- Download the HDF_EOS 2.7v1.00 source code and test drivers from <http://hdfeos.gsfc.nasa.gov/hdfeos/softwarelist.cfm>
- Since read_hdf.c produces a pgm file as an output example, you must download the PBMPLUS toolkit from <http://www.acme.com/software/pbmplus>
- Check that the following include files are present:

stdio.h	(standard include)
hdf.h	(hdf library include)
HdfEosDef.h	(hdfeos library include)
pgm.h	(pgm library include)

- You can use the following makefile as a template (to be adapted to your environment)

```

=====
#
# Makefile (example) :
#
=====

SOFT=soft

CMS=$(SOFT)/cms

INC_CMS=-I/$(CMS)/include
INC_HDF=-I/$(SOFT)/hdf/include
INC_HDFEOS=-I/$(SOFT)/hdfeos/include
INC_PBMPLUS=-I/$(SOFT)/pbmplus/include
INC_ALL=$(INC_CMS) $(INC_HDF) $(INC_HDFEOS) $(INC_PBMPLUS)

LNK_HDF=-L/$(SOFT)/hdf/lib -lmfhdf -ldf -ljpeg -lz -lnsl
LNK_HDFEOS=-L/$(SOFT)/hdfeos/lib -lhdfeos -lGctp
LNK_PBMPLUS=-L/$(SOFT)/pbmplus/lib -lpnm -lppm -lpgm -lpbm
LNK_M=-lm
LNK_ALL=$(LNK_HDF) $(LNK_HDFEOS) $(LNK_PBMPLUS) $(LNK_M)

CC=cc

read_hdf:read_hdf.c
    $(CC) -g $(INC_ALL) -o read_hdf read_hdf.c $(LNK_ALL)

```

APPENDIX H: File name convention for the dissemination of the DLI product through EUMETCAST

The following table provides the file name convention used for the dissemination of the DLI product through EUMETCAST

OSI SAF product name	Sub-product Name	Format	File name convention
MAP DLI	MAP DLI field	GRIB	S-OSI_-FRA_-MULT- MAPDLI_FIELD- <date>.grb.gz
	MAP DLI quality index field		S-OSI_-FRA_-MULT- MAPDLI_QUAL_- <date>.grb.gz
	MAP DLI Global Information File	ASCII	S-OSI_-FRA_-MULT- MAPDLI_GINF_- <date>.txt.gz
LML DLI	LML DLI field	GRIB	S-OSI_-FRA_-MULT- LMLDLI_FIELD- <date>.grb.gz
	LML DLI quality index field		S-OSI_-FRA_-MULT- LMLDLI_QUAL_- <date>.grb.gz
	LML DLI Global Information File	ASCII	S-OSI_-FRA_-MULT- LMLDLI_GINF_- <date>.txt.gz